

VERBATIM - Sterghios Moschos in conversation with Joël Ruet

JR: Do you think it is important to know the origins of a pandemic in order to fight against future pandemics?

SM: You mentioned that there might be another pandemic at some point. I think that is the only guaranteed thing. If we look at the last six years, we can count the coronavirus and at least four chances that the Ebola virus has had of becoming a widespread epidemic, including the Ebola outbreak which did become international. We can look at the Zika virus as well and what it did in terms of its impact on the Brazilian population and how very quickly it became endemic in the Asian region. I think [everyone must be alerted] to the fact that developing nations, who are required to go on and interact with the wild to resource protein from wild game, will be exposed to pathogens that developed nations would not [otherwise] be exposed to on a routine basis unless one is looking for exotic meats. There is a very strong chance that we will have another pandemic.

Does it matter in this point in time where coronavirus originated from? We [don't] want to be looking at this so much as the fact that within a year the virus that reached, in a broad sense, humanity, was able to improve itself by a thousand-fold. This is a number that has come out from experiments in how to transmit itself.

In other words, if some scientists were researching how to make a biological weapon and they all went wrong, clearly they weren't doing their job properly because nature found a way of doing it better. Considering how we have the capacity, if we want, to make things much more efficient in the lab, before we actually take them out into the community, makes me think from a completely different perspective that this was not a biological weapon created in a lab, either intentionally or accidentally.

I don't think [the coronavirus] was released [during] the study of different bat pathogens with potential pandemic risks. The reason this is additionally backed is the data that has come out with the genome of this particular virus versus the genomes of other bat viruses. Only this week we had a publication from Public Health of England which reported the presence of not closely related but well-related viruses in British bats that have 70-90% homological proteins to coronavirus-SarsCoV-2. This tells us that this stuff is out there and just because people interact with wild animals that we become exposed to it. The moment this interaction makes its way into a densely urban environment, it's a numbers exercise: how many opportunities does the pathogen have to [come into repeated human contact] before randomly, one of those individual viruses, has the capacity to jump from human to human. If that step is made, in an urban environment, the outcome of that is a pandemic. This is where we are right now. This is real life. This is exactly what's happened.

JR: How scientifically credible is the hypothesis of an 'accidental leak'? Could the virus have come out of a laboratory?

SM: The absolute right of evidence suggests that the virus is natural of origin, a zoonosis, meaning that it came out of bats. Now, did it come out of bats because somebody farmed those bats or hunted those bats or because somebody extracted the virus from bats and was not as cautious in the laboratory? Frankly I don't think we'll be ever able to come to the bottom of this. Does it matter for the future? It matters because we need to work to support communities to not need to go and feed on bats or play under the

trees with fruit bats in West Africa and catch Ebola, for example. Because that's how that one started. These kind of "where-did-it-come-from" questions help us to understand what we need to do to prevent this from happening again. The lab-leaked hypothesis is credible because not six months before that, the United States Army Medical Research Institute for Infectious Diseases in the United States, with whom I've had the luxury of collaborating with in the past, had accidentally released some virological agent as part of their work and had to shut down the labs to ensure that the practices got better. Several years before, the very prestigious Pirbright Institute in the United Kingdom had also released an animal pathogen accidentally in its wastewater. We are humans. Mistakes happen. What we can do is take a little bit more seriously risk assessment procedures. The UK love a risk assessment procedure, to perhaps sometimes ridiculous levels, but incidents like these, incidents like a reactor blowing up because someone didn't flick a switch correctly, show the need for the risk assessment to be proportionate to the risk involved and for the individuals participating in the work, which is high in risk, to be very careful, very meticulous, constantly supervised to make sure that they don't forget about something.

JR: Why do you say we might never know the origins of Covid-19?

SM: Assuming for a moment that this was a lab-leak, to be able to evidence that you would need to find the first few individuals that caught the virus and timeline the infection of those individuals alongside the known now start of the outbreak to be able [to identify how the infection began from which laboratorian who then passed it onto x, y and z]. That can work if we have samples from that period. If those samples do not exist, we don't have the tools to do so. I'm afraid it's as simple as that. It's almost like looking for a fingerprint that somebody's wiped off. In this instance, it's not that they've wiped it off, it's just that time has gone by and covered up the trail and there is no fingerprint anymore. If this [was] a laboratory leak, unless there's a paper trail somewhere [which maps out the spreading of the infection from the people working in a particular setting, whose family and friends then became infected by an unknown pneumonia, the same infection which was then detected in the food market next door, can this hypothesis be considered]. But it's still not hard evidence. We all come down with a myriad of things that never get tested for what they are on an annual basis in the millions if not billions across other nations. That doesn't mean that the pandemic started fifteen years ago in the backstreets of Montpellier, for example. It's got nothing to do with that. It's what that particular data set says. The closest other pathogen that we have comes from a cave in a completely different region of China. It so happens some of the people who died from this disease early are known to have gone hunting in that cave to get bats. The simplest explanation is that these traders were hunting for bats that just happened to have the virus that just happened to infect them. [That is] the simplest explanation.

JR: The WHO, who conducted an initial mission in China, is now considering a second mission. Is there any scientific basis for a second mission?

SM: I think it's very important at this point to explain what the WHO is and what it is not. The WHO is just an advisory organization. It has no policing powers, investigational powers or anything along those lines. The WHO is not controlled by, but is, a United Nations instrument. When we are looking at a political instrument, making certain requests and recommendations, we want to consider what are the political forces behind some of those recommendations. In this instance, there was an investigation. It involved highly respected scientists who have no reason to say this was done perfectly well when it wasn't. Peter Daszak one of those individuals, for example, who was actually quite obvious [in stating that they did not

see everything they would have liked to have seen, only some of the things they would have liked to have seen].

The consequence of those statements are gaps. Gaps in our understanding, what-if questions that hadn't been given fully. Unfortunately, one of the problems and consequences of transparency, is that you end up feeding the trolls. In this instance, the people who love a conspiracy theory will have just jumped onto that, [insisting in a self-amplifying cycle that the WHO were hiding something and why]. Whilst there were perhaps different circumstances in which the WHO may have been satisfied with, or the committees within the WHO may have been satisfied sufficiently that the evidence was on balance and favoring civil missions, all this clamor of demand for additional information [means] we have to go and collect more information, if possible, to try and allay these vocal concerns. Again, it might have more to do with politics than it has to do with science.

There is no such thing as the perfect experiment. There is no such thing as a perfect evidence either. Every piece of evidence has a point at which it may start to falter. I am not a forensics scientist, but it applies to forensics science. It applies in medicine; it applies in all sciences. Even physicists would use ridiculous levels of evidence-covering to [justify the possible existence of a new particle, even though the chances that it is not real is in the billions. This is the level of probability that they accept as evidence, which is then reported]. Will we ever be able to satisfy those trolls? I don't think so. Can we do more to try and collect more information? I think that's a reasonable decision to take. I would welcome an open answer from [the Chinese authorities which presents the evidence of what happened, enabling collaborations to take place in the future to ensure such events do not happen again].

It's not about who caused this. It's about what do we do to prevent this from happening again. We should be talking about what have we learned in the past twelve months. What stops transmission? Have we killed flu? We literally have stopped the transmission of flu for a year. It's not that doctors don't diagnose it anymore, it's because the tests can tell us something. They don't just give us a positive result. The flu doesn't exist at this point in time in large numbers. What can we learn from this to improve our lifestyles and our wellbeing? Do I have to go to work if I'm coughing and spluttering to infect all my colleagues who will take it home, destroy other businesses, schools and families, all those things? Obviously not. Do you have to pollute the environment by even taking public transport to go to work? What about pushing a push bike? That still needs rubber tires, that is pollution. No. I can do a lot of my work from home, I shouldn't be doing it from another location for the reasons I've just explained. All these things need to be taken seriously stock of because in this year of 2021, we've experienced killer floods in the European Union, Canada hitting fifty degrees, a pandemic, the Anthropocene, we've experienced all this disruption and all we can say is 'oh, let's go back to normal'? But normal is causing all of this. Maybe we need to change normal. That's my humble opinion.

JR: Do you think different lines of research in biology, in medicine, in clinical treatment, ought to cooperate across disciplines and internationally?

SM: The absolute marvelous achievement of these hundreds of thousands of genomes of the virus shared openly between research globally from the start of the pandemic from China until now, [is that it has] helped us understand the transmission, track the variants, share information about the experiments we need to do in order to understand what's going on. We need to stop thinking about individual glory, [be it scientist or research institutions], and start thinking about common good, the impact on society and the

economy that we have achieved positively by this open way of working. There aren't changes that are necessary at international and national levels which will enable this to happen. For example, the problem we have with the vaccine distribution is, number one, the sharing of knowledge on how to make these and, number two, the patents. Truth is, governments can waive the patents. But if you don't know how to implement those patents into reality, all you're making is pea soup. Elon Musk has not been very popular these last few days because he's wasting a lot of energy going to space as opposed to helping the planet. Even his views on the pandemic have been challenging at the best of times, but the man did the right thing: he gave away the patents around electric vehicles when he realized the impact they would have on the environment. Will he think more along the same lines? Science, we cannot continue anymore in the same way of working. We have to think of different ways that will allow the population, the society and economy globally to benefit. Otherwise, we're up for a really rough ride in the next few decades.

JR: We hear a lot today in the media about the problem of variants and the vaccine distribution. Is this a scientific issue or a political issue?

SM: First of all, from the early days of the pandemic, the way we have changed our understanding of the virus and what it means has indicated that it is critical that scientists from different disciplines talk to each other. Most of us who have worked on virus evolution have been very vocal about the risks of ongoing transmission, [of] enabling the virus to evolve. Low and behold, a year later, we're already running out of Greek letters to identify variants of interest. That's pretty quick. Originally, coronavirologists thought coronaviruses don't evolve very fast. But they never had the opportunity to watch them spread so quickly or so broadly. All disciplines in science need to listen to other disciplines in science and work together. [According to] the international community, the medical community [should stop being] so proud about itself and its understanding of biological science and medical science. The airborne transmission problem has been one of those key issues here.

On the back of that, the political disruption in the last five years, if not longer, [from] the US elections of 2016, the Brexit decision in the United Kingdom, [to] the emergence of populists in Europe, Brazil and the States, created the perfect recipe for disaster in terms of managing epidemics correctly. The few nations that listened to the scientists, have actually done really well throughout this pandemic, including countries like Vietnam, which wouldn't roll off your tongue as a scientifically developed nation. I have a Vietnamese PhD student for whom I have huge respect, he is amazing. Where people don't seem to care about the science or are ruled by ideology, the consequences for the economy and the population are dire. Science doesn't care about ideology; the virus doesn't think. It just does what it wants to do, what it's evolved to do which is to transmit, to mutate and adapt to the new circumstances it's presented with. This is where we are right now. We have the Delta variant which, against the background of no vaccination, was responsible for bodies running down the Ganges. Four million extra deaths in India in the first half of 2021.

Against the background of vaccination, the nations which are vaccinated are seeing 92-95% reduction in deaths. In hospitalizations the numbers are hugely reduced, which is great news. But, as an evolutionary virologist, or rather based on the work I've done on virus evolution over the last few years, I can, heart on heart, tell you that what we are doing in Britain right now is what I would have done in my lab if I wanted to evolve a virus that's resistant to vaccine. If something keeps me up at night about Autumn 2021 and Winter 2022, is data that will come out of some semi-vaccinated country, probably Britain, where the vaccine just doesn't work anymore for some people. Again, people from different disciplines are not listening. Evolutionary biologists are saying why not go beyond the spike protein, look at the mutation

libraries which exist, pick and mix these things, make new vaccine boosters which will probably hit all these new evolution variants? [Whilst] the companies that have made vaccines already are saying let's just give another dose of this vaccine to the already-vaccinated population. These people are adequately protected from these existing variants. You need to be dosing the Africans. You need to be dosing the South-East Asians. You don't need to be dosing for a third time the USA and Israel and Britain and Europe. Yes, it may reduce somewhat hospitalizations against the future variants, but you can't guarantee by how much and you can't be sure by how much or if at all, because you don't know what the future variants are going to be. You need to outsmart the virus in its own game if you want to win this. The answer to that is virus evolution. But what do I know? I'm just a guy in a university in the North-East corner of the UK so I'd better go out and enjoy the few hours of sunshine we have right now before it disappears again.